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# PROVIDER COMPLIANCE AND COMPETENCE WITH ORAL CANCER SCREENINGS IN THE U.S. ARMY

A Thesis

Presented to the Faculty of the Advanced Education in General Dentistry, Two-Year Program,

United States Army Dental Activity, Fort Hood, Texas

And the Uniformed Services University of the Health Sciences – Post Graduate Dental College

In Partial Fulfillment of the Requirements for the Degree of

Master of Science in Oral Biology

By

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April 2016

# PROVIDER COMPLIANCE AND COMPETENCE WITH ORAL CANCER SCREENINGS IN THE U.S. ARMY

An investigation of the self-reported compliance and competence with oral cancer screenings of  
dental providers in the U.S. Army

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## ABSTRACT

**Purpose:** The purpose of this study was to evaluate the level of provider compliance with oral cancer screenings as mandated by the DoD Dental Procedure codes D0120, D0150, and D0180, and to make a basic assessment of provider training and comfort in performing oral cancer screenings.

**Methods:** This study employed a one-tailed online survey that provided descriptive information about the presence or absence of compliance with oral cancer screenings as well as the feeling of competence to complete an oral cancer screening among the providers who responded. It also attempted to identify barriers to provider compliance so that we may understand and create more effective teaching and subsequently improved dental care quality. A link to the survey was emailed to active duty military 63A and 63B providers worldwide; 217 providers responded, and 206 responses were valid. All responses were anonymous.

**Results:** Hypothesis #1 states that army providers perform oral cancer screenings for all new patients, recall, and periodontal exams according to DoD guidelines. This hypothesis is rejected due to as many as 13.7% of providers not complying with these guidelines.

Hypothesis #2 states that army dental providers feel competent and confident in their ability to perform proper oral cancer screenings. This hypothesis is also rejected due to the data results corresponding to this hypothesis. 17.1% of respondents reported receiving inadequate training in dental school for oral cancer screening, 50.7% of respondents feel uncomfortable performing oral cancer biopsies, and 78.8% of respondents feel that more training would improve their oral cancer screenings.

Hypothesis #3 states that practices and habits of oral cancer screenings in the Army is optimal. This hypothesis is rejected for the following reasons: 13.8% of respondents do not follow a standard oral cancer screening protocol, as many as 26.4% of respondents report having too little time for adequate oral cancer screenings during exams, and providers reported the weakest data in the study for patient education. As many as 57.5% of providers do not regularly educate patients on self-monitoring for oral cancers, and up to 73.2% of providers do not educate their patients on the oral cancer risk of human papilloma virus (HPV).

**Conclusion:** The data in this study suggests that oral cancer screenings in the Army do not occur with the 100% frequency required by DoD guidelines, and that the confidence level of providers in performing oral cancer screenings needs improvement. The investigator concludes that the rate of screening may be improved by increasing the confidence level of providers

through more oral cancer screening education during Officer Professional Development (OPD) and other CE opportunities. Furthermore, the rate of patient education about risk factors and self-monitoring is far lower than would be expected in this at-risk population. Options for improving patient education, such as waiting room videos and educational pamphlets, are discussed.



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## Introduction

### *Discovering Oral Cancer*

In the past, many dental providers considered oral cancer to be a disease of 60+ year old male smokers, but that demographic is quickly shifting to a younger, non-smoking population (35, 32, 11). Furthermore, the rate of oral cancer diagnoses has increased every year for the past eight years, concerning many researchers and scientists (32). With changing demographics and increasing incidence, oral cancer screening should be an important service provided at every patient visit (1, 22).

Oral cancers may occur in all areas of the mouth, including the lips, hard and soft tissues, tongue, tonsils, and throat. Many times these cancers are found in the salivary glands and lymph nodes in the head and neck (3). The Oral Cancer Foundation estimates that 48,330 people in the U.S. will be diagnosed with oral cancer in 2016, and that 9,570 of those people diagnosed this year will die (32). One of the biggest dangers of oral cancer is that it can go unnoticed until it reaches advanced stages: it can be painless and not cause many physical changes. Approximately 70% of oral cancers are found as late stage cancers (stages 3 or 4) which contribute greatly to the mortality rate (19). When discovered at early stages of development (stages 1 or 2) the five year mortality rate drops significantly (32). Figure 1 below shows the 5 year survival rate by stage for some oral cancers.

**Figure 1 - 5 Year Relative Survival Rate by Stage, American Cancer Society (4)**

The following survival statistics come from the National Cancer Institute's SEER program, and are based on a large population diagnosed between 2000 and 2014. Cancers are divided into summary stages as follows:

- Local: the cancer is only in the area where it started. This includes stages I and II, as well as some stage III cancers that haven't spread to any lymph nodes.
- Regional: the cancer has spread to nearby tissues and/or lymph nodes. This includes some stage III cancers, as well as stage IV cancers that haven't spread to distant sites.
- Distant: the cancer has spread to distant site.

### **LIP**

Stage	5 Year Relative Survival Rate
Local	93%
Regional	48%
Distant	52%

### **TONGUE**

Stage	5 Year Relative Survival Rate
Local	78%
Regional	63%

Distant	36%
---------	-----

#### **FLOOR OF THE MOUTH**

<b>Stage</b>	<b>5 Year Relative Survival Rate</b>
Local	75%
Regional	38%
Distant	20%

Oral cancers develop when genetic mutations which control cell behavior occur. These errant cell behaviors are uncontrolled growth or proliferation, an inability to repair DNA damage within itself, or the cell's refusal to undergo pre-programmed death, known as apoptosis. One mutation is not enough to create a cancerous cell, but after several generations of mutation, it may be capable of passing on its mutations to all of its progeny when it divides. Mutations can occur randomly, or these genetic errors can be inherited, be caused by viruses, or develop as a result of exposure to chemicals or other toxins (32). Even though our bodies have mechanisms that destroy abnormal cells, these mechanisms sometimes fail, allowing cancers to develop.

As with most cancers, signs and symptoms vary because of the multifaceted etiology of oral cancer (34) and the multiple types of cells found in the oral cavity (38). Silverman et. al. lists some common signs and symptoms of oral cancer:

- Ulceration or erosion. Destruction of epithelial integrity owing to discrepancy in cell maturation, loss of intercellular attachments, and disruption of basal lamina (basement membrane).
- Erythema. Redness reflecting inflammation, thinness and irregularity of epithelium, and lack of keratinization.
- Induration. Hardness owing primarily to an increase in the number of epithelial cells and secondarily to an inflammatory infiltrate.
- Fixation. Abnormally dividing cells invading deeper areas of muscle and bone.
- Chronicity. Failure to heal. Cancer is not a spontaneously reversible disease. Therefore, a malignant lesion normally will not disappear in the absence of definitive antitumor therapy.
- Lymphadenopathy. Hardening and/or enlargement of regional nodes owing to engorgement with neoplastic cells that spread by lymphatic vessels. Nodes are usually painless and often become fixed because of capsular erosion and local infiltration. Tumors that involve marked induration, fixation, and lymphadenopathy are signs of advanced cancer.
- Leukoplakia. A white patch on the mucosal surface, reflecting excess epithelial keratin production. Hyperkeratosis is often associated with well-differentiated carcinomatous lesions. Excess keratin also may be produced within the stratified squamous epithelium and can appear as "keratin pearls" (38).

Many patients discover oral cancer when they begin to feel a lump or thickening of the soft tissues, or experience swelling that affects the fit of their oral appliances. A patient may develop difficulty with chewing or swallowing, moving their jaw or tongue, discover red or white patches in their mouth, a sore throat, have a feeling that something is caught in their throat, hoarseness, a voice change, numbness, or a "canker sore" that lasts more than 14 days (6, 40). In some cases, the presenting symptom could be a persistent ear ache (32), loose teeth with no apparent cause, unusual bleeding in the nose or mouth (11), weight loss, and persistent bad breath (3).

As mentioned earlier, about 70% of oral cancers are found during advanced stages (19, 38, 32, 2). Despite easy access to the oral cavity, only one-third of oral cancers are detected in the early stages (22). This late stage diagnosis makes the death rate for oral cancer higher than those for cervical cancer, Hodgkin's Lymphoma, testicular cancer, melanoma, and endocrine system cancers (32). The Oral Cancer Foundation states that, "Late stage diagnosis is not occurring because most of these cancers are hard to discover...it is because of a lack of public awareness coupled with the lack of a national program for opportunistic screenings which would yield early discovery by medical and dental professionals"(32, 35). Also, early carcinoma of the oral cavity is likely painless or associated with only mild irritation causing many patients to forgo a visit to the dentist (38). The cancerous lesions may also look like a canker sore or an accidental bite to the cheek or tongue, a minor injury that many people would expect to heal on its own (35). Unfortunately, it is only when a toothache refuses to resolve, a lump is found in the neck, or other such issue is discovered that a patient seeks professional assistance. By that time, the oral lesion has metastasized into other tissues (38). Because oral cancer is usually found in advanced stages, a patient diagnosed with oral cancer lesions should receive a thorough examination for metastasis in other areas, especially the larynx, esophagus, and lungs (5).

Many factors affect the outcomes of patients with oral cancers, such as the type of cancer, location, stage, and treatment modalities. While many patients following treatment will have little to no physical malformation, some will have difficulty speaking and eating, or have permanent facial disfigurement (30). Half of all oral cancer patients will die within five years (11). In addition, patients who have had an oral cancer will need follow-up cancer screenings the rest of their lives due to the rate of developing secondary tumors in nearby areas: experts expect oral cancer survivors to have a 20 times greater risk of developing a secondary cancer (4).

### *Etiology*

Oral cancers have a multifaceted etiology (34) with the majority of these causes being life-style choices (9, 32, 40). Whether used as cigarettes, cigars, or smokeless tobacco, tobacco remains the major and most preventable cause of oral cancers (34, 32, 35, 11, 6). Estimates of the percentage of oral cancers caused by tobacco range from 75% to 90% (34) although that rate may be decreasing due to the increase of another etiology - HPV (31, 32). One study found that male smokers were 27.7 times more likely to develop oral cancer over their lifetimes than non-

smokers. Of course, consumption factors such as the amount of tobacco used daily and the length of years one has used tobacco products increase the risk (9). Furthermore, scientists agree that the mortality rate for smokers who have oral cancers is far higher than that of non-smokers: they die at 5 to 10 times the rate of non-smokers. Cigars and pipes have risks similar to cigarettes because the majority of the carcinogens in tobacco smoke are the byproduct of pyrolysis, which is composed of over 4,000 different compounds, including some that are pharmacologically active, toxic, mutagenic, or carcinogenic (34).

If danger lies in the tobacco smoke, many tobacco users feel that they are making a safer choice by choosing a smokeless tobacco product. The Oral Cancer Foundation disagrees and states a reason why this choice may be more dangerous. The Foundation reports:

"Smokeless tobacco also contains carcinogens, some at extremely high levels. It is especially significant that the preparation of smokeless tobacco products, which entails curing, fermentation, and aging, occurs under conditions favoring the formation of tobacco-specific N-nitrosamine (TSNAs) from nicotine and other tobacco alkaloids such as nornicotine, anatabine, and anabasine. During tobacco chewing and snuff dipping, it is likely that additional amounts of carcinogenic TSNAs are also formed endogenously in the oral cavity.

Two of the six TSNAs identified in smokeless tobacco, N-nitrosornicotine (NNN) and 4-(methylnitrosamino)-1 3-pyridyl-1-butanone (NNK), are strong carcinogens in mice, rats, and hamsters, capable of inducing both benign and malignant tumors of the oral and nasal cavity as well as of the lung, esophagus and pancreas. Polynuclear aromatic hydrocarbons (PAHs) in tobacco smoke have been implicated extensively in oral carcinogenesis, and NNK and NNN, which are found in both tobacco and tobacco smoke, likely play a major etiological role in cancers of the oral cavity as well.

In summary, in light of the vast number of toxic and carcinogenic compounds that exist in tobacco and tobacco smoke and the level of exposure to these agents among tobacco users, it is not surprising that tobacco use is so profoundly implicated in the causation of human cancer. A number of these compounds have been directly implicated in the production of oral carcinomas and exist in both cigarette smoke and in smokeless tobacco in concentrations that have induced oral malignancies in laboratory animals (34)."

Clearly, the use of any tobacco product increases oral cancer risk substantially.

Alcohol consumption remains the largest cause of oral cancer in non-smokers (35, 6, 34, 37). Beer, hard liquor, and wine have each been implicated as causes of oral malignancies. It seems that the type of alcohol is not important in linking causality, but the level of consumption determines risk. One study showed that as little as 120 grams of alcohol daily increases oral cancer risk (34). Researchers have had a difficult time pinpointing a risk threshold for alcohol

consumption, however, because many heavy alcohol consumers also use tobacco products, have poor diets, and underreport their alcohol use due to bias (34).

Studies have found that a synergistic carcinogenic effect is created when alcohol and tobacco products are consumed together (6, 37). The Oral Cancer Foundation cites several studies that support this fact (34).

Another etiology of oral cancers is viruses (3, 34, 32, 11). Certain viruses can cause cancer in the following way:

"Alterations of cellular oncogenes, which lead to altered expression of their products, have been implicated in human cancers. Cellular oncogenes, also known as proto-oncogenes, acquire their transforming properties or become activated by gene amplification, point mutations, and gene rearrangements. Oncogenes can encode growth factors and growth factor receptors, act on internal signaling molecules, and regulate DNA transcription factors. Other genes encode proteins that inhibit the cell cycle or promote programmed cell death (apoptosis). Tumor suppressor genes may become inactivated or mutated with consequential loss of control over cell division. The retinoblast and gene products are examples.

Consideration of risk factors should recognize that many molecular events governing control of cell cycles are influenced by viruses. Those most commonly implicated in oral cancer transformation have been the human papilloma virus (HPV), herpes group viruses, and the adenoviruses. Of these, HPV and herpes have been the most thoroughly studied and are now considered to be the most likely "synergistic viruses" involved in human oral cancer. The herpes viruses most often linked to oral cancer are the Epstein-Barr virus (EBV) and cytomegalovirus (CMV) (34)."

Human papilloma virus (HPV-16), a newly identified etiology of oral cancers (9), is quickly becoming the primary cause of oral cancers in younger patients and has shifted the etiologic profile of people who get oral cancers to a younger population (35, 30, 31). According to the Oral Cancer Foundation and recent discoveries detailed in peer reviewed published materials, data indicates that the HPV-16 virus may be replacing alcohol as the primary causative agent of oral cancer in non-smoking patients under 50 years old (32). In fact, a 2011 press release from the Oral Cancer Foundation stated that HPV is "now the leading cause of oral cancers in the U.S." As mentioned above, Epstein-Barr and cytomegalovirus have shown an oral cancer etiology as well, but are less common than HPV.

The rise in HPV related oral cancers poses a new screening challenge to all practitioners as the former demographic of "60+ year old male smokers" must now include males and females of any age who engage in unprotected oral sex. The screening challenge complicates further by the fact that, while tobacco and alcohol lesions tend to present on the anterior tongue and mouth, HPV lesions tend to favor the posterior oral cavity - a more difficult place to spot lesions for the patient and practitioner (34).

Because HPV-16 is sexually transmitted through partners primarily through oral sex, this etiology remains preventable as a "lifestyle choice". Many people are now aware that HPV can cause cervical cancer but little has been done to educate the public about the oral cancer risk of contracting this virus. Furthermore, many people may assume that the HPV vaccine may protect them from HPV-induced oral cancer. While this may be true, studies have not yet determined if HPV vaccines can prevent oropharyngeal cancers (12).

Additionally, HPV does not seem to have any synergistic effect with other causative agents, but instead presents "a completely unique and independent disease process" (32).

Diet has a possible association with oral cancer (16). Research shows that people who eat a diet rich in vegetables and fruits experience a lower incidence of oral cancer. Conversely, people whose diets are low in fruits and vegetables have an increased incidence of oral cancer (11, 9). Most focus has been given to the antioxidants beta-carotene, and vitamins E and C. Of 54 studies that evaluated the effect of fruit and vegetable intake in the development of upper digestive tract cancers, researcher Garewal found 52 studies that showed that a diet high in fruits and vegetables produced a protective effect (34). In his abstract for "Antioxidants in oral cancer prevention", Dr. Garewal states:

"I present evidence in support of a chemopreventive role for the so-called antioxidant nutrients, beta-carotene and vitamin E, against oral cavity cancer. This evidence is from laboratory studies, animal model systems, epidemiologic surveys, intervention trials involving reversal of premalignant changes, and prevention of malignancies in particularly high-risk subjects. Because agents proposed for disease prevention are meant to be used widely without close medical supervision, almost any toxicity is unacceptable. Beta-Carotene and vitamin E fulfill this criterion for a suitable chemopreventive agent. In several epidemiologic studies, low intakes of vitamin E, carotenoids, or both have been associated with a higher cancer risk. Smoking, a major risk factor, results in lower beta-carotene concentrations in plasma and oral mucosal cells. In several laboratory and animal model systems, beta-carotene and other antioxidant nutrients are inhibitors of oral cavity carcinogenesis. Beta-Carotene and vitamin E can produce clinical regression of oral leukoplakia, a premalignant lesion for oral cancer. The design and limitations of such studies in oral leukoplakia are discussed. Cancer incidence reduction trials in high-risk groups have targeted prevention of secondary malignancies in patients cured of a primary oral cancer. These trials are in progress. The data thus far are supportive of a significant preventive role for these nutrients in oral cancer (16)."

Clearly this researcher, as do many others, believe that a diet high in antioxidants found in fruits and vegetables plays an important role in prevention, and perhaps the treatment, of oral cancers. Specifically, low beta-carotene intake correlates positively with an increased risk of



lung, laryngeal, gastric, ovarian, breast, cervical, and oral cancers. A low vitamin C intake correlates with an increased risk of stomach, esophageal, oral, laryngeal, and cervical cancers. And while low serum levels of vitamin E more than double the risk of gastrointestinal cancers, supplementation with vitamin E correlates with a decreased risk for oral and pharyngeal cancers. The general consensus of researchers and scientists is that high fruit and vegetable consumption produces a protective effect against many cancers, including oral cancers (34).

Radiation can cause oral cancer. Of the many types of radiation that can cause cancer, sunlight is the most prevalent (9). Sunlight, through actinic radiation (a type of radiation that causes photochemical effects) can facilitate cancer production along the vermilion border of the lip (6). Fair-skinned individuals carry greater risk of developing cancers from sunlight than do dark-skinned individuals (34).

Another type of radiation that can cause cancer is exposure to x-rays. Although x-rays taken during regular doctor or dental exams are commonly considered safe, radiation exposure is accumulative over a lifetime and has been implicated in several head and neck cancers (32).

Gender appears to play a large role in oral cancer risk as males are twice as likely to develop oral cancers. However, that statistic may be misleading because males in general use larger amounts of alcohol and tobacco (6, 9).

Age increases the risk of developing any type of cancer (27), including oral cancers. The jump in risk for non-HPV related oral cancer occurs at 44 years old (6) with two-thirds of all people diagnosed with oral cancer being over 55 years old (9). According to Zongli Xu, Ph.D. and Jack Taylor, M.D., Ph.D., researchers from the National Institute of Environmental Health Sciences studied DNA methylation, or the binding of chemical tags called methyl groups, onto DNA which has long been suspect in age-related cancer formation (43). DNA methylation seems to be part of the natural aging process. Dr. Taylor describes it; "You can think of methylation as dust settling on an unused switch, which then prevents the cell from turning on certain genes. If a cell can no longer turn on critical developmental programs, it might be easier for it to become a cancer cell." The more cells age, the less able they are to properly correct mistakes or develop properly. In all cancer types, they found significantly increased DNA methylation. Their study even determined the rate of methylation. Dr. Xu explains that methylation events occur at the rate of one per year in our cells, so, "On your 50th birthday, you would have 50 of these sites that have acquired methyl groups in each cell. The longer you live, the more methylation you will have" (27). Therefore, age increases cancer risk.

The Cancer Treatment Centers of America list several less-common causes of cancer (9):

- Genetic syndromes such as Fanconi anemia and dyskeratosis congenita. Fanconi anemia is a blood condition inherited by abnormalities in several genes which often lead to leukemia or aplastic anemia. The risk of oral cancer in individuals with this condition is up to 500 times higher than among the general population. Dyskeratosis is a genetically linked syndrome that can also cause aplastic anemia and carries a very high risk of mouth and throat cancer occurring at an early age.
- Betel quid, as tobacco, is associated with an increased oral cancer risk. Many people in southeast Asia, south Asia, and other parts of the world chew betel quid, a leaf from the betel plant wrapped around areca nut and lime.
- Immune system suppression, such as when taken immune suppressant drugs following a transplant or to treat certain immune diseases, or HIV, is linked to an increased risk of developing oral cancers.
- Lichen planus, when severe, causes itchy rashes but sometimes appears as white lines or spots in the mouth and throat. This infection may increase oral cancer risk.
- Graft-versus-host disease (GVHD) can occur after a stem-cell transplant into bone marrow as a cancer treatment. The new stem cells may generate an immune response against the host's cells, destroying tissues as a result. Oral cancer may appear as soon as 2 years following GVHD.

Recently, mouthwash, denture irritation, poor dental hygiene, and marijuana use have been implicated in oral cancer development. Currently these causations remain unproven (9).

As with most cancers, oral cancer treatment varies by type and stage of cancer. Late stage cancers must be treated more aggressively than early stage cancers, with surgery, radiation, and chemotherapy as the standard options (5).

Can oral cancers be prevented? In the majority of cases, yes (34, 25). Because many oral cancers are lifestyle related, the Centers for Disease Control recommends reducing or eliminating alcohol and tobacco use, using a barrier method when practicing oral sex, eating a diet rich in fruits and vegetables, and seeing a dentist regularly to receive an oral cancer screening (11). And of course education; understanding the causative factors of oral cancer may encourage individuals to make informed health choices (32).

### *The Dentist's Role*

The dental practitioner plays an important role in the prevention and detection of oral cancers as oftentimes early carcinomas are painless or only mildly irritating, and go unnoticed by the individual (38). Regular dental check-ups where oral cancer screenings are routine can find pre-cancers and cancers in earlier stages, thus improving patient outcomes (2, 6, 8, 37). One study showed a 34% reduction in mortality among high-risk subjects when oral cancer

screenings were regularly performed (18). A trained professional should spot a suspicious lesion and know when to "watch and wait" or proceed with a biopsy (32). This presents a dilemma for the practitioner because many "ill-defined, variable-appearing, controversial, and poorly understood" benign lesions present in the oral cavity that may easily be confused with malignancy (37). When suspicious lesions or lumps are present, The American Cancer Society recommends a visual and palpative clinical exam of the mouth and throat with the following procedures (2):

- Toluidine blue, when spread over an abnormal area, will stain blue.
- Certain lasers that use light-induced fluorescence after 5-aminolevulinic acid (ALA) can show a differentiation between the healthy tissue and different stages of pre-malignancy and malignancy (23).
- Biopsy

An example of a thorough oral cancer screening protocol can be found at the Oral Cancer Foundation's website (22).

While screening can catch oral cancer in pre-malignant or early stages, the quickly growing HPV-related demographic presents a more difficult challenge for detection. Because HPV lesions tend to favor the posterior oral cavity, they are more difficult to locate (35, 32).

#### *Oral Cancer Screening in the Army*

With the advent of HPV-related cancers, the question arises, "Who should receive oral cancer screenings?" When once screenings were performed for high risk individuals, "high risk" can no longer be defined by alcohol and tobacco use. Therefore, the Oral Cancer Foundation encourages "opportunistic mass screening" as the only viable option to find oral cancer early in development (35). In the military, the DoD Guidelines for Dental Procedure Codes require oral cancer screenings "where indicated" for new patients (D0150), recall (established) patients (D0120), and patients receiving a comprehensive periodontal evaluation (D0180) (1). See Figure 2 for the complete descriptions of the above mentioned DoD dental provider codes.

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### **Figure 2 - DoD Guidelines for Dental Procedure Codes and Dental Weighted Values (1)**

#### **D0120 Periodic oral evaluation - established patient**

An evaluation performed on a patient of record to determine any changes in the patient's dental and medical health status since a previous comprehensive or periodic evaluation. This includes an oral cancer evaluation and periodontal screening where indicated and may require interpretation of information acquired through additional diagnostic procedures. Report additional diagnostic procedures separately.

#### **D0150 Comprehensive oral evaluation - new or established patient**

Used by a general dentist and/or a specialist when evaluating a patient comprehensively. This applies to new patients; established patients who have had significant change in health conditions or other unusual circumstances, by report; or established patients who have been absent from active treatment for more than three years. It is a thorough evaluation and recording of the extraoral and intraoral hard and soft tissues. It may require interpretation of information acquired through additional diagnostic procedures. Additional diagnostic procedures should be reported separately. This includes an evaluation for oral cancer where indicated, the evaluation and recording of the patient's dental and medical history and a general health assessment. It may include the evaluation and recording of dental caries, missing or unerupted teeth, restoration, existing prosthesis, occlusal relationships, periodontal conditions (including periodontal screening and/or charting), hard and soft tissue anomalies, etc.

#### **D0180 Comprehensive periodontal evaluation - new or established patient**

This procedure is indicated for patients showing signs or symptoms of periodontal disease and for patients with risk factors such as smoking or diabetes. It includes evaluation of periodontal conditions, probing and charting, evaluation and recording of the patient's dental and medical history and general health assessment. It may include the evaluation and recording of dental caries, missing or unerupted teeth, restorations, occlusal relationships and oral cancer evaluation.

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With the directive to perform oral cancer screenings "where indicated", other vital questions emerge: Do Soldiers carry the same amount of oral cancer risk as the general population, and are Soldiers receiving adequate and periodic oral cancer screenings during their routine dental evaluations?

#### *Oral Cancer Risk in the Army*

To determine the amount of oral cancer risk Soldiers carry, their risk behavior must be measured. Tobacco use, alcohol consumption, and HPV risk, the three largest etiologic factors for oral cancer, will be examined to determine the risk factors for Soldiers.

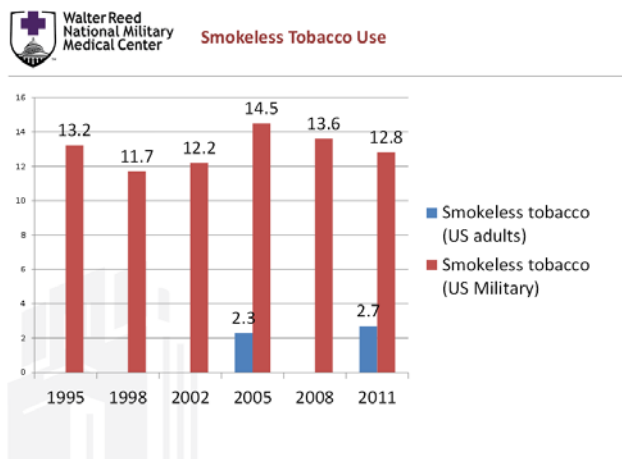
Tobacco use remains the most prevalent factor for oral cancer etiology (34, 32, 35, 11, 6), but with the median age of Soldiers in the US Army being 29 years old (39), the largest incidence of oral cancers lies in the older veteran demographic (27) and tobacco-related healthcare costs in the VA support this claim (42). The article "Repercussions of High Military Smoking Rates Affect Health Systems" states that, "Already, the long-term costs are nothing short of astronomical. The VA spent more than \$6 billion in 2008 treating diseases such as COPD [a tobacco-related disease]. The Institute of Medicine (IoM) found, meanwhile, the DoD's cost of treating tobacco-related diseases is estimated to be more than \$500 million per year for medical care and \$346 million in lost productivity (42)." The CDC also reports a higher smoking rate among veterans than the civilian population; 36% of 45-54 year-old veterans smoke compared to 24% of those who have never served in the military.

Still, tobacco use is 50% higher in the military than in the civilian population, and tobacco use increases further during deployment (42, 29, 28). Dr. Michael Wilson, a pulmonary physician, studied the tobacco use of Soldiers while deployed in Iraq. He found that almost two-thirds of the Soldiers he studied there used tobacco products (which is twice the rate of the general population), and argues that the rate of tobacco use has inclined steeply in the last few

years despite the Army's smoking cessation programs (29). Tobacco-related illnesses affect the younger active duty population as well. The IoM has argued that "military personnel who smoke have reduced physical performance capacity, lower visual acuity and poorer night vision than nonsmokers. Smoking is associated with hearing loss and increased risks of motor vehicle collisions, physical injury and hospitalization," and indeed contribute to the approximate \$1.9 billion a year spent by the DoD on tobacco-related illness and lost productivity (12).

Of particular concern is the rate of smokeless tobacco use in the Army (14) (see Figure 3). As mentioned previously, the Oral Cancer Foundation believes that smokeless tobacco use may be more dangerous than smoked tobacco products (34, 36, 13). As of 2011, the rate of smokeless tobacco use in the military was almost 5 times higher than the general adult population (24), which could translate into increased incidence of disease and cost to the DoD in the near future.

Figure 3 - Smokeless Tobacco Use in the Military, Walter Reed National Medical Center (24)



The largest non-tobacco etiological oral cancer factor besides HPV is alcohol consumption (35, 34, 6). According to the National Institute on Alcohol Abuse and Alcoholism, heavy drinking (defined as consuming five or more drinks per typical drinking occasion at least once a week) appears to be a particularly pernicious problem in the military (21, 7). Rates of heavy drinking in the Army among young men are reported to be twice that of non-military young men. Young women in the Army also may drink heavily: among female Army recruits, one-third reported binge drinking in the previous 30 days, about five times the civilian rate of 6% to 7% (21). The Institute of Medicine reports that the percentage of active-duty service members who binge-drink shot from 35% in 1998 to 47% in 2008, with this discovery prompting their statement that alcohol abuse among troops is a "public health crisis" (20).

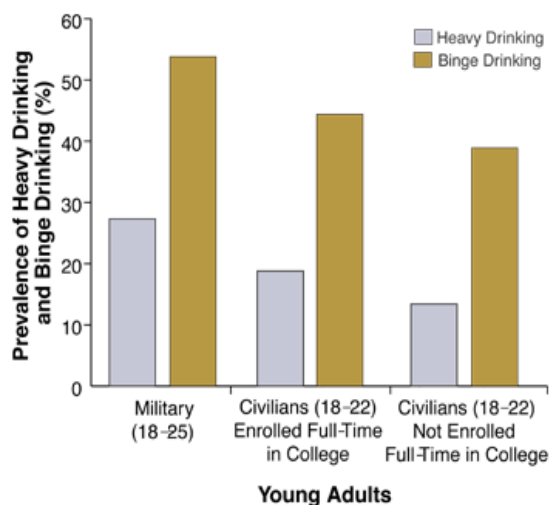
Alcohol has been a part of the military culture since the Revolutionary War: troops drink for fun, to develop brotherhood, and to ease the stresses of war (21, 26). This heavy drinking problem increases further during wartime, with Soldiers experiencing multiple deployments in the greatest risk group for alcoholism (26). Because alcohol consumption in the military dwarfs that of the general population (33) (see Figures 4 and 5), it follows that Soldiers' risk of developing oral cancer is also higher than the general population's.

**Figure 4 - National Institute on Drug Abuse (26)**

**Standardized Comparisons of the Prevalence of Heavy Alcohol Use<sup>a</sup> Among 18- to 25-Year-Old Military Personnel and Civilians, Past 30 Days, by Gender, 2001–2002**

	Comparison Population					
Gender	Civilian	Total DOD	Army	Navy	Marine Corps	Air Force
Males	17.8% (0.5)	32.2% (2.3) <sup>b</sup>	32.8% (2.5) <sup>b</sup>	31.8% (3.5) <sup>b</sup>	38.6% (4.0) <sup>b</sup>	24.5% (3.2) <sup>b</sup>
Females	5.5% (0.3)	8.1% (1.0) <sup>b</sup>	6.3% (1.7)	11.5% (2.7) <sup>b</sup>	12.9% (2.3) <sup>b</sup>	6.3% (1.4)
In Total Population	15.3% (0.4)	27.3% (2.1) <sup>b</sup>	27.6% (2.4) <sup>b</sup>	26.0% (4.0) <sup>b</sup>	35.4% (4.8) <sup>b</sup>	19.8% (2.0) <sup>b</sup>

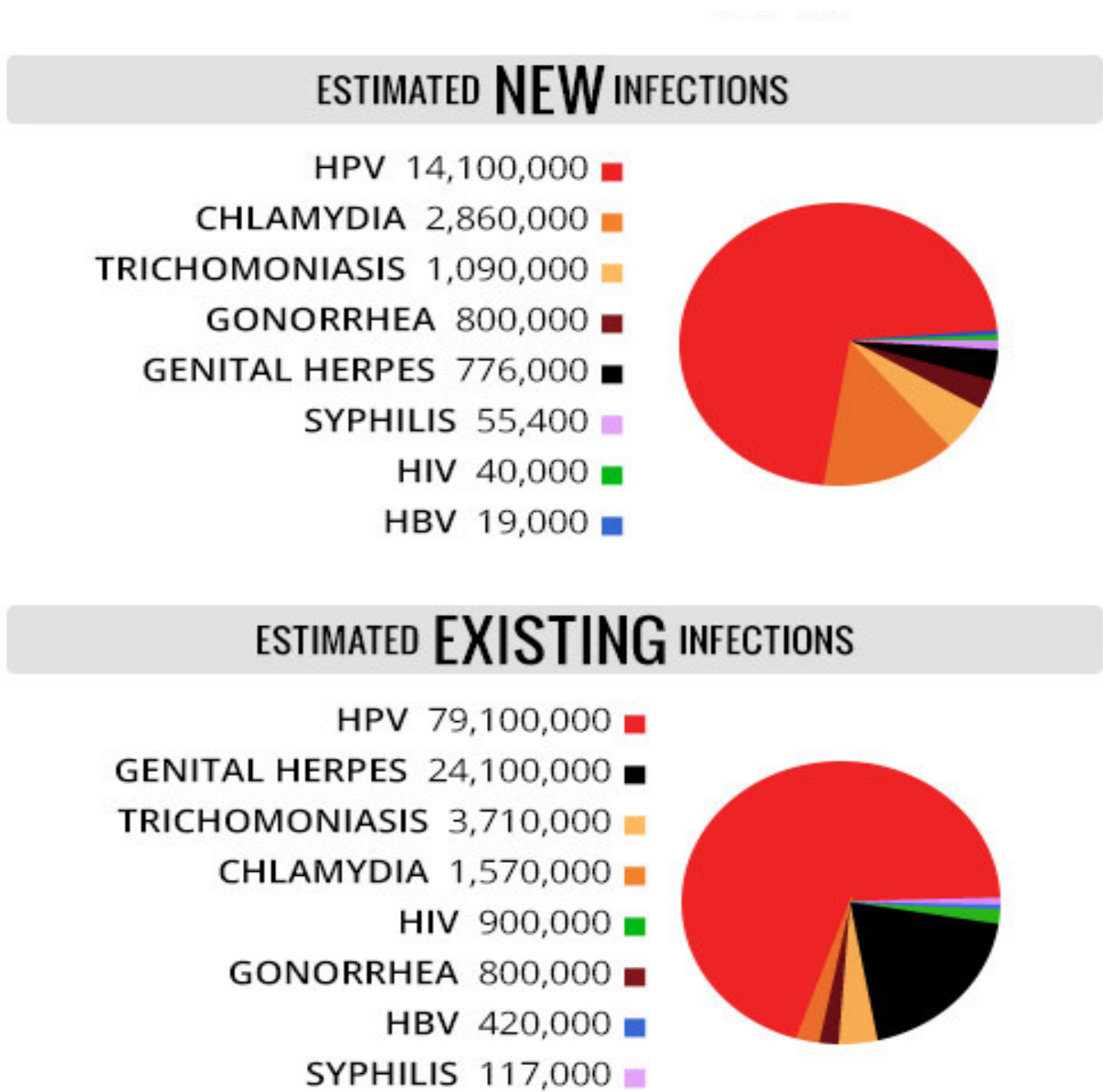
NOTE: Table entries are percentages, with standard errors in parentheses.



**Figure 5 - Heavy and Binge Drinking, Military v. Civilian**  
National Institute of Health (7)

HPV is by far the most common STI, affecting over 79,000,000 in the U.S. alone (17) (see Figure 6). Because HPV may never cause symptoms, many people are unaware of infection and spread the virus to other partners. As this statistic relates to oral cancers, eighty percent of sexually active people have oral sex (41), thereby presenting oral HPV infection risk.

**Figure 6 - "Hidden STD Epidemic: 110 Million Infections in the U.S." LiveScience (17)**



Unsafe sexual practices, such as low condom use and multiple casual partners, contribute to the rate of STI diagnosis. The article, "Military responds to high rates of STIs in active duty female service members," reports several disturbing statistics:

"Low rates of condom use likely contribute to high rates of STIs, note the researchers. A study included in the analysis found that 68% of Army servicewomen did not regularly use condoms and only 37% had used one with their last casual sexual partner. Among women with five or more sexual partners in the previous 12 months, 53% reported using a condom the last time they had sex.

A high number of sexual partners may also be a factor. Nearly 60% of active-duty women reported more than one sexual partner in the previous year, and 27% said they had more than one partner in the preceding three months. Of those, only 17% said their partner always used a condom (41)."

This article also states that the rates of Soldiers with HPV has dropped in the past years, likely due to the HPV vaccine Gardasil. However, while HPV infection may have decreased in Soldiers, studies have not yet determined if HPV vaccines can prevent oropharyngeal cancers (12). Until Gardasil has been proven to prevent oral HPV infection, thereby preventing HPV-caused oral cancers, safe oral sexual practices must be encouraged.

**Figure 7 - Centers for Disease Control and Prevention (12) - Possible rates of HPV exposure**



According to the data, Soldiers engage in a higher than average sexual promiscuity rate in the military (10) (see Figure 7), and thereby could have an increased risk of developing oral cancers in their lifetimes especially if Gardasil does not protect against oral cancers.

Because Soldiers tend to use tobacco products, consume alcohol, and engage in unsafe sexual practices more often than the general population, they are logically at a higher risk of developing oral cancers in their lifetimes than the general population. Regular

and competent oral cancer screenings will be imperative to protecting the health of Soldiers and Veterans in the years to come.



## Purpose

Beginning in 2010, the Commission on Dental Accreditation (CODA) approved a mandatory new standard of competence in providing oral cancer screenings for dental and oral hygiene schools. No requirement for competence was required before this time, nor have providers been remunerated for performing oral cancer screenings. So logic follows that oral cancer screenings by providers who graduated prior to 2010 may be inferior due to lack of training or remuneration, or not performed at all (2).

The purpose of this study was to evaluate the level of provider compliance with oral cancer screenings as mandated by the DoD Dental Procedure codes D0120, D0150, and D0180, and to make a basic assessment of provider training and comfort in performing oral cancer screenings.

To determine what actions may increase the rate and quality of oral cancer screenings in the conclusion, survey question responses were extrapolated. For example, all questions in the survey pertained to one of three categories:

**Category 1.** Training and Comfort - the provider's level of training and comfort in performing oral cancer screenings,

**Category 2.** Habits and Practices - the provider's habits and practices of oral cancer screenings,

**Category 3.** Compliance - the provider's compliance to DoD Dental Procedure codes D0120, D0150, and D0180.

Data responses in the "strongly disagree" to "neutral" scores for questions 1, 3, 5, 6, 9-14, 18, 19, 22, and 27 pertain to category 1 and demonstrate a low level of training and comfort with performing oral cancer screenings, and may point to a need for further training. Data responses in the "strongly disagree" to "neutral" scores for questions 2, 4, 7, 8, 15-17, 20, 21, and 23 pertain to category 2 and may show lax habits in oral cancer screening. A statistically significant response in this manner to these questions may show a need for an oral cancer screening protocol. Data received from questions 24-26, and 28 pertain to category 3, compliance to DoD 120, 150, and 180 - are Army providers performing oral cancers screenings as required?

## Hypotheses

**Study questions:** Do Army dental providers perform regular oral cancer screenings as mandated by D0120, D0150, and D0180? Do Army dental providers feel that oral cancer screenings are important services to provide? Do Army dental providers feel competent and confident in their ability to perform proper oral cancer screenings? Are Army dental providers educating their patients on oral cancer risk factors?

**Hypothesis #1:** Army providers perform oral cancer screenings for all new patients, recall, and periodontal exams according to the DoD guidelines.

**Hypothesis #2:** Army dental providers feel competent and confident in their ability to perform proper oral cancer screenings.

**Hypothesis #3:** The practices and habits of providers for oral cancer screenings in the Army are optimal.

## Methods and Materials

An online survey was formulated in Survey Monkey. A link to the survey (<https://www.surveymonkey.com/s/VJ82NN6>) was distributed via a controlled email distribution list to participants. COL McClary, the Investigator's Residency Director, distributed the linked email to U.S. Army Dental Command locations worldwide (See Appendix A: Email with Survey Link).

The study population receiving the linked email included general (63A) and comprehensive (63B) dentists in the U.S. Army. This population only included active duty military providers located worldwide. All survey responses were anonymous.

Data was collected using a 28 question survey (Table 1) using a 5-point Likert scale design. Specifically, all questions on the survey related directly to these three points:

1. Level of provider compliance to D0120, D0150, and D0180.
2. Provider's feelings of competence in completing a thorough oral cancer screening.
3. Practices and habits of providers for oral cancer screenings of each responding provider.

This one-tailed test sought to find as much data as possible toward the 5 (Strongly agree) end of the scale, showing a strong level of knowledge, confidence, and oral cancer screening provision.

The data was tabled, charted, and examined by a statistician, Dr. John Ward (see Table 1). Dr. Ward analyzed the data by estimating the probability of selecting each response on the survey. The 95% confidence interval of a probability estimate was calculated using the Wald equation:

$$95\% \text{ C.I.} = E = 1.96 * [(p) * (1-p) / n]^{0.5}.$$

$$95\% \text{ C.I.} = E = 1.96 * [(0.50) * (1-0.50) / 200]^{0.5} = 0.069.$$

This method uses a normal approximation to the binomial probability distribution that requires there be at least 5 observations in each arm of the distribution. When the sample size is too small, the sensitivity is estimated by adding two successes and two failures for the adjusted Wald interval (Agresti and Coull 1998, GraphPad Software Inc. 1999). In the case of this project, the sample size was large enough to apply the standard Wald equation for each distribution.

A minimum of 200 subjects were needed to have statistically significant results: 217 subjects responded and 206 responses were valid. Therefore, the investigator was able to estimate the probability of each response with a 95% confidence of  $\pm 6.9\%$ .

The descriptive statistics (see Table 2 in the Results section) show that values that differ by 6.8% or more are statistically significant.

Approximately 450 active duty 63A and 250 active duty 63B dentists were invited to participate via a controlled linked email distribution list provided throughout the Dental Command: 217 valid responses were received between Sept. 21, 2015 and Sept. 28, 2015.

**Table 1**

**Study Survey**  
**Oral Cancer Screening in the Army**

**All answers are anonymous.**

		<b>Strongly Disagree (1)</b>	<b>Disagree (2)</b>	<b>Neutral (3)</b>	<b>Agree (4)</b>	<b>Strongly Agree (5)</b>
1.	Oral cancer is a threat to the health of our Soldiers.					
2.	I follow a specific protocol for oral cancer screening.					
3.	I received adequate training in dental school to perform thorough oral cancer screenings.					
4.	I have enough time during patient exams for oral cancer screening.					
5.	The Army provides adequate continuing education on performing oral cancer screening.					
6.	I am comfortable performing oral cancer screenings.					
7.	Army general dentists should perform oral cancer biopsies.					
8.	I always educate my patients on risk factors for oral cancer.					
9.	Smoking increases oral cancer risk.					
10.	Alcohol use increases oral cancer risk.					
11.	Smoking and alcohol use combined multiply oral cancer risk greatly.					
12.	Gender is a risk factor for oral cancer.					
13.	Sun exposure is a risk factor for oral cancer.					
14.	Age is a risk factor for oral cancer.					
15.	I always educate my patients on self-monitoring for oral cancer.					
16.	I routinely refer patients who smoke to a cessation program.					
17.	I always examine radiographs for signs of oral cancer.					
18.	I feel that oral cancer screening in the Army is adequate.					
19.	I feel that my performance of oral cancer screenings is adequate.					
20.	When I see an oral lesion, I ensure that my patient undergoes adequate follow-up.					
21.	I feel that 5 minutes or less is enough time to educate patients on oral cancer risk.					
22.	Oral sex with someone who has certain types of HPV is an oral cancer risk.					
23.	I educate my patients on the oral cancer risk of HPV.					
24.	Every new and recall patient should be given an oral cancer screening.					

25.	If the Army provided a specific oral cancer screening protocol, my rate of screening would increase.					
26.	If I had time during my exams specifically assigned to oral cancer screening, my rate of screening would increase.					
27.	More training would increase my oral cancer screening quality.					
28.	I adhere to Army treatment guidelines requiring oral cancer screenings for all new and recall patients.					

Thank you for your participation.

## Results

**Hypothesis #1:** Army providers perform oral cancer screenings for all new patients, recall, and periodontal exams according to the DoD guidelines.

Data received from questions 24, 25, 26, and 28 pertain to hypothesis 1, compliance to DO120, DO150, and DO180. Are Army providers performing oral cancers screenings as required?

**24. Every new and recall patient should be given an oral cancer screening.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
3	3	1.4	1.4	1.4
4	87	40.1	41.0	42.5
5	122	56.2	57.5	100.0
Total	212	97.7	100.0	
Missing	5	2.3		
Total system	217	100.0		

**25. If the Army provided a specific oral cancer screening protocol, my rate of screening would increase.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	14	6.5	6.6	6.6
2	41	18.9	19.2	25.8
3	52	24.0	24.4	50.2
4	65	30.0	30.5	80.8
5	41	18.9	19.2	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

**26. If I had time during my exams specifically assigned to oral cancer screening, my rate of screening would increase.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	10	4.6	4.7	4.7
2	51	23.5	24.2	28.9
3	48	22.1	22.7	51.7
4	62	28.6	29.4	81.0
5	40	18.4	19.0	100.0
Total	211	97.2	100.0	
Missing	6	2.8		
Total system	217	100.0		

**28. I adhere to Army treatment guidelines requiring oral cancer screenings for all new and recall patients.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	5	2.3	2.4	2.4
3	24	11.1	11.3	13.7
4	112	51.6	52.8	66.5
5	71	32.7	33.5	100.0
Total	212	97.7	100.0	
Missing	5	2.3		
Total system	217	100.0		

**Hypothesis #2:** Army dental providers feel competent and confident in their ability to perform proper oral cancer screenings.

Data responses in the "strongly disagree" to "neutral" scores for questions 1, 3, 5, 6, 9-14, 18, 19, 22, and 27 pertain to hypothesis 2 and demonstrate a low level of training and comfort with performing oral cancer screenings, and may point to a need for further training.

**1. Oral cancer is a threat to the health of our Soldiers.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	2	.9	.9	.9
2	4	1.8	1.8	2.8
3	10	4.6	4.6	7.4
4	107	49.3	49.3	56.7
5	94	43.3	43.3	100.0
Total	217	100.0	100.0	

**3. I received adequate training in dental school to perform thorough oral cancer screenings.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	2	.9	.9	.9
2	11	5.1	5.1	6.0
3	24	11.1	11.1	17.1
4	106	48.8	49.1	66.2
5	73	33.6	33.8	100.0
Total	216	99.5	100.0	
Missing	1	.5		
Total system	217	100.0		

**5. The Army provides adequate continuing education on performing oral cancer screenings.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	17	7.8	7.9	7.9
2	55	25.3	25.6	33.5
3	74	34.1	34.4	67.9
4	49	22.6	22.8	90.7
5	20	9.2	9.3	100.0
Total	215	99.1	100.0	
Missing	2	.9		
Total system	217	100.0		

**6. I feel comfortable performing oral cancer biopsies.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	28	12.9	13.0	13.0
2	81	37.3	37.7	50.7
3	44	20.3	20.5	71.2
4	49	22.6	22.8	94.0
5	13	6.0	6.0	100.0
Total	215	99.1	100.0	
Missing	2	.9		
Total system	217	100.0		

**9. Smoking increases oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	3	1.4	1.4	1.4
3	2	.9	.9	2.3
4	58	26.7	27.1	29.4
5	151	69.6	70.6	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

**10. Alcohol use increases oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	5	2.3	2.3	2.3
3	11	5.1	5.1	7.5
4	86	39.6	40.2	47.7
5	112	51.6	52.3	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

**11. Smoking and alcohol use combined multiply oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	1	.5	.5	.5
3	1	.5	.5	.9
4	42	19.4	19.6	20.6
5	170	78.3	79.4	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

**12. Gender is a risk factor for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	1	.5	.5	.5
2	33	15.2	15.4	15.9
3	61	28.1	28.5	44.4
4	89	41.0	41.6	86.0
5	30	13.8	14.0	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

**13. Sun exposure is a risk factor for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	4	1.8	1.9	1.9
2	18	8.3	8.5	10.3
3	32	14.7	15.0	25.4
4	93	42.9	43.7	69.0
5	66	30.4	31.0	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		



**14. Age is a risk factor for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	2	.9	.9	.9
2	8	3.7	3.8	4.7
3	16	7.4	7.5	12.2
4	108	49.8	50.7	62.9
5	79	36.4	37.1	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

**18. I feel that oral cancer screening in the Army is adequate.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	8	3.7	3.7	3.7
2	50	23.0	23.4	27.1
3	65	30.0	30.4	57.5
4	78	35.9	36.4	93.9
5	13	6.0	6.1	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

**19. I feel that my performance of oral cancer screenings is adequate.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	1	.5	.5	.5
2	12	5.5	5.6	6.1
3	32	14.7	15.0	21.1
4	124	57.1	58.2	79.3
5	44	20.3	20.7	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

**22. Oral sex with someone who has certain types of HPV is an oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	1	.5	.5	.5
2	5	2.3	2.3	2.8
3	9	4.1	4.2	7.0
4	91	41.9	42.7	49.8
5	107	49.3	50.2	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

**27. More training would increase my oral cancer screening quality.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	11	5.1	5.2	5.2
2	14	6.5	6.6	11.8
3	20	9.2	9.4	21.2
4	118	54.4	55.7	76.9
5	49	22.6	23.1	100.0
Total	212	97.7	100.0	
Missing	5	2.3		
Total system	217	100.0		

**Hypothesis #3:** The practices and habits of providers for oral cancer screenings in the Army are optimal.

Data responses in the "strongly disagree" to "neutral" scores for questions 2, 4, 7, 8, 15-17, 20, 21, and 23 pertain to hypothesis 3 and may show lax habits in oral cancer screening.

**2. I follow a specific protocol for oral cancer screening.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	9	4.1	4.1	4.1
3	12	5.5	5.5	9.7
4	93	42.9	42.9	52.5
5	103	47.5	47.5	100.0
Total	217	100.0	100.0	

**4. I have enough time during patient exams for oral cancer screening.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	6	2.8	2.8	2.8
2	20	9.2	9.3	12.0
3	31	14.3	14.4	26.4
4	98	45.2	45.4	71.8
5	61	28.1	28.2	100.0
Total	216	99.5	100.0	
Missing	1	.5		
Total system	217	100.0		

**7. Army general dentists should perform oral cancer biopsies.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	7	3.2	3.3	3.3
2	35	16.1	16.3	19.5
3	60	27.6	27.9	47.4
4	83	38.2	38.6	86.0
5	30	13.8	14.0	100.0
Total	215	99.1	100.0	
Missing	2	.9		
Total system	217	100.0		

**8. I always educate my patients on risk factors for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	28	12.9	13.0	13.0
3	52	24.0	24.2	37.2
4	88	40.6	40.9	78.1
5	47	21.7	21.9	100.0
Total	215	99.1	100.0	
Missing	2	.9		
Total system	217	100.0		

**15. I always educate my patients on self-monitoring for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	6	2.8	2.8	2.8
2	60	27.6	28.0	30.8
3	57	26.3	26.6	57.5
4	66	30.4	30.8	88.3
5	25	11.5	11.7	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

**16. I routinely refer patients who smoke to a cessation program.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	10	4.6	4.7	4.7
2	77	35.5	36.0	40.7
3	55	25.3	25.7	66.4
4	56	25.8	26.2	92.5
5	16	7.4	7.5	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

**17. I always examine radiographs for signs of oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	5	2.3	2.3	2.3
2	16	7.4	7.5	9.9
3	24	11.1	11.3	21.1
4	102	47.0	47.9	69.0
5	66	30.4	31.0	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

**20. When I see an oral lesion, I ensure that my patient undergoes a follow-up.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	3	1.4	1.4	1.4
3	13	6.0	6.1	7.5
4	115	53.0	54.0	61.5
5	82	37.8	38.5	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

**21. I feel that 5 minutes or less is enough time to educate patients on oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	3	1.4	1.4	1.4
2	32	14.7	15.0	16.4
3	48	22.1	22.5	39.0
4	110	50.7	51.6	90.6
5	20	9.2	9.4	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

**23. I educate my patients on the oral cancer risk of HPV.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	16	7.4	7.5	7.5
2	93	42.9	43.7	51.2
3	47	21.7	22.1	73.2
4	46	21.2	21.6	94.8
5	11	5.1	5.2	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

Table 2 (shown below) charts the statistical results of each question in the survey. However, the results per question are not grouped according to their corresponding hypothesis as stated in the Methods and Measurements section, but are chronological.

**Table 2 - Descriptive Statistics**

	<b>Descriptive Statistics</b>				<b>95% CI</b>		
	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Low</b>	<b>High</b>
1.Oral cancer is a threat to the health of our soldiers.	217	1	5	4.3	0.7	2.9	5.8
2.I follow a specific protocol for oral cancer screening.	217	2	5	4.3	0.8	2.8	5.8
3.I received adequate training in dental school to perform thorough oral cancer screenings.	216	1	5	4.1	0.9	2.4	5.8
4.I have enough time during patient exams for oral cancer screening.	216	1	5	3.9	1.0	1.9	5.9
5.The Army provides adequate continuing education on performing oral cancer screening.	215	1	5	3.0	1.1	0.9	5.1
6.I feel comfortable performing oral cancer biopsies.	215	1	5	2.7	1.1	0.5	4.9
7.Army general dentists should perform oral cancer biopsies.	215	1	5	3.4	1.0	1.4	5.4
8.I always educate my patients on risk factors for oral cancer.	215	2	5	3.7	1.0	1.4	5.4
9.Smoking increases oral cancer risk.	214	2	5	4.7	0.6	3.5	5.8
10.Alcohol use increases oral cancer risk.	214	2	5	4.4	0.7	3.1	5.8
11.Smoking and alcohol use combined multiply oral cancer risk.	214	2	5	4.8	0.5	3.9	5.7
12.Gender is a risk factor for oral cancer.	214	1	5	3.5	0.9	1.7	5.4
13.Sun exposure is a risk factor for oral cancer.	213	1	5	3.9	1.0	2.0	5.9
14.Age is a risk factor for oral cancer.	213	1	5	4.2	0.8	2.6	5.8
15.I always educate my patients on self-monitoring for oral cancer.	214	1	5	3.2	1.1	1.1	5.3
16.I routinely refer patients who smoke to a	214	1	5	3.0	1.1	0.9	5.0

cessation program.							
17.I always examine radiographs for signs of oral cancer.	<b>213</b>	<b>1</b>	<b>5</b>	<b>4.0</b>	<b>1.0</b>	<b>2.1</b>	<b>5.9</b>
18.I feel that oral cancer screening in the Army is adequate.	<b>214</b>	<b>1</b>	<b>5</b>	<b>3.9</b>	<b>0.8</b>	<b>2.4</b>	<b>5.5</b>
19.I feel that my performance of oral cancer screenings is adequate.	<b>213</b>	<b>1</b>	<b>5</b>	<b>3.9</b>	<b>0.8</b>	<b>2.4</b>	<b>5.5</b>
20.When I see an oral lesion, I ensure that my patient undergoes a follow-up.	<b>213</b>	<b>2</b>	<b>5</b>	<b>4.3</b>	<b>0.6</b>	<b>3.0</b>	<b>5.6</b>
21.I feel that 5 minutes or less is enough time to educate patients on oral cancer risk.	<b>213</b>	<b>1</b>	<b>5</b>	<b>3.5</b>	<b>0.9</b>	<b>1.7</b>	<b>5.3</b>
22.Oral sex with someone who has certain types of HPV is an oral cancer risk.	<b>213</b>	<b>1</b>	<b>5</b>	<b>4.4</b>	<b>0.7</b>	<b>3.0</b>	<b>5.8</b>
23.I educate my patients on the oral cancer risk of HPV.	<b>213</b>	<b>1</b>	<b>5</b>	<b>2.7</b>	<b>1.0</b>	<b>0.7</b>	<b>4.8</b>
24.Every new and recall patient should be given an oral cancer screening.	<b>212</b>	<b>3</b>	<b>5</b>	<b>4.6</b>	<b>0.5</b>	<b>3.5</b>	<b>5.6</b>
25.If the Army provided a specific oral cancer screening protocol, my rate of screening would increase.	<b>213</b>	<b>1</b>	<b>5</b>	<b>3.4</b>	<b>1.2</b>	<b>1.0</b>	<b>5.7</b>
26.If I had time during my exams specifically assigned to oral cancer screening, my rate of screening would increase.	<b>211</b>	<b>1</b>	<b>5</b>	<b>3.3</b>	<b>1.2</b>	<b>1.0</b>	<b>5.6</b>
27.More training would increase my oral cancer screening quality.	<b>212</b>	<b>1</b>	<b>5</b>	<b>3.8</b>	<b>1.0</b>	<b>1.9</b>	<b>5.8</b>
28.I adhere to Army treatment guidelines requiring oral cancer screenings for all new and recall patients.	<b>212</b>	<b>2</b>	<b>5</b>	<b>4.2</b>	<b>0.7</b>	<b>2.8</b>	<b>5.6</b>
Valid N (listwise)	<b>206</b>						

## Discussion

**Hypothesis #1: Army providers perform oral cancer screenings for all new patients, recall, and periodontal exams according to DoD guidelines.**

Data received from questions 24, 25, 26, and 28 pertain to Hypothesis 1, compliance to DO120, DO150, and DO180. All values that differ by 6.8% or more are statistically significant.

**24. Every new and recall patient should be given an oral cancer screening.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
3	3	1.4	1.4	1.4
4	87	40.1	41.0	42.5
5	122	56.2	57.5	100.0
Total	212	97.7	100.0	
Missing	5	2.3		
Total system	217	100.0		

98% of the respondents agreed that every new and recall patient should be given an oral cancer screening. The 1.4% that responded "neutral" is not a statistically significant amount. This question was created to gauge the providers' feelings of importance for oral cancer screenings, as well as their knowledge of DoD requirements. Providers appear to be aware of the DoD requirements and believe that oral cancer screening is important.

**25. If the Army provided a specific oral cancer screening protocol, my rate of screening would increase.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	14	6.5	6.6	6.6
2	41	18.9	19.2	25.8
3	52	24.0	24.4	50.2
4	65	30.0	30.5	80.8
5	41	18.9	19.2	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

25.8% of providers disagreed that a specific Army oral cancer screening protocol would increase their rate of screening, while 24.4% of providers felt neutrally, and 49.7% of providers felt that a specific protocol would increase their rate of screening. The investigator assumed that, since oral cancer screening protocols were not required to be taught in dental school prior to 2010,

some providers would benefit from training, and that an estimate of the number of those dentists could be found. The investigator also sought to find out whether oral cancer screening guidance was necessary, and since almost half of the providers agreed with statement #25, the investigator assumes that protocol guidance is necessary.

The data for question 25 appear to be quite scattered which could point to several interpretations:

1. Providing a specific oral cancer screening protocol, or giving extra time during an appointment for oral cancer screening, will improve the rate of oral cancer screenings for about 50% of the providers.
2. Some providers already adhere to a screening protocol and do not wish to alter it.
3. Time to provide oral cancer screenings is not an issue affecting the rate of screenings, but other factors, such as level of confidence, may be.
4. The questions may have been unclear to certain respondents. For example, some providers may be unclear as to what the DoD oral cancer screening guidelines are.

**26. If I had time during my exams specifically assigned to oral cancer screening, my rate of screening would increase.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	10	4.6	4.7	4.7
2	51	23.5	24.2	28.9
3	48	22.1	22.7	51.7
4	62	28.6	29.4	81.0
5	40	18.4	19.0	100.0
Total	211	97.2	100.0	
Missing	6	2.8		
Total system	217	100.0		

28.9% of providers responded that time given specifically for oral cancer screening during exams would not improve their rate of screening, while 48.4% felt that it would improve their rate of screening. It is interesting to note that the responses for "agree" are nearly twice that of "disagree". The investigator not only wanted to see if time constraint decreased the rate of screenings, but also if whether allowing more time for screenings would increase the rate of screenings. The results, however, can be misleading: How many providers cannot increase their rate of screening because they already screen at 100%? This question could have yielded clearer results if it stated, "I feel that Army providers in general would increase their oral cancer screening rate if time was specifically provided for screenings during exams." However, it appears that the rate of screening would increase if time were allotted during exams specifically for oral cancer screenings.



**28. I adhere to Army treatment guidelines requiring oral cancer screenings for all new and recall patients.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	5	2.3	2.4	2.4
3	24	11.1	11.3	13.7
4	112	51.6	52.8	66.5
5	71	32.7	33.5	100.0
Total	212	97.7	100.0	
Missing	5	2.3		
Total system	217	100.0		

13.7% of providers either do not adhere to Army treatment guidelines requiring oral cancer screenings for all new and recall patients, or replied that they felt neutrally about it. In this case, does a neutral response admit to not adhering to treatment guidelines for every new and recall patient? 86.3% of providers responded that they do follow Army treatment guidelines for oral cancer screenings.

While 98.5% of respondents agreed that new and recall patients should always be given oral cancer screenings, 13.7% of the providers may not be providing oral cancer screenings at those appointments as evidenced from the data for question 28. That result is twice the amount needed to prove a statistically significant amount.

Are Army providers performing oral cancers screenings as required? It seems that the data collected does not support Hypothesis #1 because not all Army providers are performing oral cancer screenings for all new patients, recall, and periodontal exams according to the DoD guidelines. Hypothesis #1 must be rejected because its standards of 100% screenings 100% of the time are not being met.

Another question must be asked: Because the Army does not require a specific oral cancer screening protocol, but only requires that a screening be performed, how adequate are the screenings being performed? This study did not attempt to measure screening adequacy, but it is a logical next step in determining the level of screening care the Soldiers receive.

The data suggests that providers do not perform oral cancer screenings at least 13.7% of the times that they are required to do so, and with the inaccuracy of self-reporting bias, that rate may be higher. Why are they not performing oral cancer screenings every time they see a new or recall patient? Perhaps information gathered for Hypotheses #2 and #3 will elucidate those reasons.

**Hypothesis #2: Army dental providers feel competent and confident in their ability to perform proper oral cancer screenings.**

Data responses for questions 1, 3, 5, 6, 9-14, 18, 19, 22, and 27 pertain to hypothesis 2 and could reveal the level of training and comfort with performing oral cancer screenings.

**1. Oral cancer is a threat to the health of our Soldiers.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	2	.9	.9	.9
2	4	1.8	1.8	2.8
3	10	4.6	4.6	7.4
4	107	49.3	49.3	56.7
5	94	43.3	43.3	100.0
Total	217	100.0	100.0	

Although 92.6% of the providers surveyed agreed that oral cancer is a threat to the health of our Soldiers, 7.4% either disagreed or did not have an opinion. This question seeks to obtain the level of basic risk knowledge about oral cancer. It appears that 92.6% of respondents know that oral cancer risk factors affect Soldiers. Do the 7.4% that disagreed or did not have an opinion about the level of risk to Soldiers have very little knowledge about oral cancer risk factors? Or do they feel that the risk is low because of the excellent standard of care they provide in oral cancer screenings? Is it that they believe that, since our mean Soldier age is 29 (23), oral cancer will need several more decades to develop and therefore not be an issue for Soldiers? Or perhaps do they believe that the risk factors for oral cancer are low in the Army, or that oral cancer is rare and very few people will develop it?

**3. I received adequate training in dental school to perform thorough oral cancer screenings.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	2	.9	.9	.9
2	11	5.1	5.1	6.0
3	24	11.1	11.1	17.1
4	106	48.8	49.1	66.2
5	73	33.6	33.8	100.0
Total	216	99.5	100.0	
Missing	1	.5		
Total system	217	100.0		

A statistically significant amount of providers, 17.1%, either do not feel that they received adequate training in dental school to perform thorough oral cancer screenings, or they feel neutrally about their training. Feelings of confidence in their training for oral cancer screenings would have been reported as 4 (agree) or 5 (strongly agree), but almost one-fifth don't show

confidence in their training. Is that an acceptable level to the Army? Would the Army prefer every provider to feel confident in their ability to perform thorough oral cancer screenings?

**5. The Army provides adequate continuing education on performing oral cancer screenings.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	17	7.8	7.9	7.9
2	55	25.3	25.6	33.5
3	74	34.1	34.4	67.9
4	49	22.6	22.8	90.7
5	20	9.2	9.3	100.0
Total	215	99.1	100.0	
Missing	2	.9		
Total system	217	100.0		

A significant amount, 33.5%, disagreed that the Army provides adequate continuing education (CE) on performing oral cancer screenings, while 32.1% agreed that CE is adequate. 34.4% had no feelings either way. What could be some reasons for this unusually equal spread across the possible answers?

1. The results show exactly how the providers feel across the continuum - 1/3 are satisfied while 1/3 are dissatisfied with their CE for oral cancer screenings.
2. The providers feel that they have enough CE already and don't want to add more.
3. The providers that scored 3 or higher may feel that they don't need more CE training for oral cancer screening because of thorough training previously.
4. The question is ambiguous. For example, the word "adequate" as used in this question can be interpreted as "fair", "good", "fine", "enough for now", etc. A better question may have been "The Army provides continuing education on performing oral cancer screenings" to gauge whether or not they continue to learn about the evolving demographics, techniques, and technologies involved in oral cancer screening.

**6. I feel comfortable performing oral cancer biopsies.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	28	12.9	13.0	13.0
2	81	37.3	37.7	50.7
3	44	20.3	20.5	71.2
4	49	22.6	22.8	94.0
5	13	6.0	6.0	100.0
Total	215	99.1	100.0	
Missing	2	.9		
Total system	217	100.0		

With 50.7% of providers disagreeing with the statement "I feel comfortable performing oral cancer biopsies," and another 20.5% not showing confidence (a neutral "3") in performing biopsies, it is clear that providers need more training in this area, or have specialists designated to perform biopsies.

**9. Smoking increases oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	3	1.4	1.4	1.4
3	2	.9	.9	2.3
4	58	26.7	27.1	29.4
5	151	69.6	70.6	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

This question measures some basic knowledge of oral cancer risk. A statistically insignificant number were unaware that smoking increases oral cancer risk. 96.3% of providers knew this common risk factor, and shows good basic knowledge. It is likely that all providers know this basic fact.

**10. Alcohol use increases oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	5	2.3	2.3	2.3
3	11	5.1	5.1	7.5
4	86	39.6	40.2	47.7
5	112	51.6	52.3	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

This question also measures basic knowledge of oral cancer risk. Slightly fewer providers (92.5%) answered positively that alcohol is an oral risk factor, but as a group, showed oral cancer risk knowledge. Perhaps this number may be lower because of some ambiguity in the question as the quantity and duration of alcohol use changes the risk for oral cancer.

**11. Smoking and alcohol use combined multiply oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	1	.5	.5	.5
3	1	.5	.5	.9
4	42	19.4	19.6	20.6
5	170	78.3	79.4	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

With 99% of respondents agreeing with the statement "Smoking and alcohol use combined multiply oral cancer risk," the providers again demonstrated good basic knowledge of oral cancer risk factors.

**12. Gender is a risk factor for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	1	.5	.5	.5
2	33	15.2	15.4	15.9
3	61	28.1	28.5	44.4
4	89	41.0	41.6	86.0
5	30	13.8	14.0	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

The question meant to identify more basic knowledge of oral cancer risk factors. 55.6% of respondents agreed that gender is a risk factor for oral cancer, and 44.4% either disagreed or chose "neutral". This question is a poor measure of basic oral cancer knowledge because, while oral cancer used to affect males at twice the rate of females due to higher tobacco and alcohol use, the balance of females to males being diagnosed has risen substantially due to HPV infection etiologies, and a decrease in the general population of tobacco use. Perhaps some of the respondents knew the changing demographics and others did not. A better information-gathering statement could have been "The gender demographic of oral cancer diagnoses has changed."

**13. Sun exposure is a risk factor for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	4	1.8	1.9	1.9
2	18	8.3	8.5	10.3
3	32	14.7	15.0	25.4
4	93	42.9	43.7	69.0
5	66	30.4	31.0	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

While most of the respondents agreed that sun exposure is a risk factor for oral cancer (74.7%), a significant number were unsure (15%) or disagreed (10.3%). In the investigator's opinion, all respondents should have known that sun exposure increases oral cancer risk.

**14. Age is a risk factor for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	2	.9	.9	.9
2	8	3.7	3.8	4.7
3	16	7.4	7.5	12.2
4	108	49.8	50.7	62.9
5	79	36.4	37.1	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

Increasing age means increasing oral cancer risk. 87.8% of respondents agreed with this statement, while 12.2% either disagreed or did not know. Again, this is a basic fact about oral cancer that all providers should know.

**18. I feel that oral cancer screening in the Army is adequate.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	8	3.7	3.7	3.7
2	50	23.0	23.4	27.1
3	65	30.0	30.4	57.5
4	78	35.9	36.4	93.9
5	13	6.0	6.1	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

This survey question produced interesting results. A substantial number of providers, 27.1%, did not agree that the oral cancer screening in the Army is adequate, and another 30.4% responded "neutral". Only 42.5% of providers felt that oral cancer screening is adequate. Do 27.1% of providers really feel that oral cancer screening in the Army needs improvement? The scattering of data requires further inquiry: Did the providers respond based on their feelings of performance, or were they rating their co-workers' performance? Do they feel that oral cancer screening is "good enough" at present? What level of thoroughness in screening is "adequate"? Do they believe that Soldiers are low risk and therefore require a lower level of screening? Did they respond to the DoD requirements and not to real-life performance? Perhaps the word "adequate" is open to too much interpretation, as discussed for question #5. The investigator believes that the substantial number of providers that do not feel that oral cancer screening in the Army is adequate needs further scrutiny.

**19. I feel that my performance of oral cancer screenings is adequate.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	1	.5	.5	.5
2	12	5.5	5.6	6.1
3	32	14.7	15.0	21.1
4	124	57.1	58.2	79.3
5	44	20.3	20.7	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

Again, the word "adequate" may be open to many interpretations. The investigator meant for the word "adequate" to mean "sufficient to find a visible or palpable oral cancer lesion if present." Ideally, all providers would feel confident in their abilities to find a cancerous lesion during a screening and would agree with statement #19. However, 21.1% of respondents did not feel confident in their oral cancer screening performance as shown by the number of "disagree" and "neutral" answers. Because this percentage is statistically significant, the investigator must ask the question, "Do one-fifth of all Army dentists feel that their oral cancer screenings are insufficient to find an oral cancer lesion if present?" and "Is that an acceptable level of vulnerability for our Soldiers?"

**22. Oral sex with someone who has certain types of HPV is an oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	1	.5	.5	2.8
2	5	2.3	2.3	7.0
3	9	4.1	4.2	49.8
4	91	41.9	42.7	100.0
5	107	49.3	50.2	

Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

This question meant to gauge the basic knowledge of HPV etiology for oral cancer. 92.9% of the respondents agreed with statement #22, showing basic knowledge. However, 7.0% did not answer affirmatively to this statement. This small but significant amount may reveal a need for further education.

**27. More training would increase my oral cancer screening quality.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	11	5.1	5.2	5.2
2	14	6.5	6.6	11.8
3	20	9.2	9.4	21.2
4	118	54.4	55.7	76.9
5	49	22.6	23.1	100.0
Total	212	97.7	100.0	
Missing	5	2.3		
Total system	217	100.0		

A large majority of respondents, 78.8%, felt that more training would increase the quality of their oral cancer screenings, while 21.2% felt that it would not, or had no opinion. It appears that Army providers and patients may benefit from increased oral cancer screening training. Of those that felt that more training would not increase their oral cancer screening quality, one must question whether those respondents already feel confident in their abilities to screen for cancer, or if they do not feel that more training would help them to improve.

Because Hypothesis #2 states that Army dental providers feel competent and confident in their ability to perform proper oral cancer screenings, this one-tailed research design seeks to find data recorded as close to 5 (strongly agree) as possible, showing a great degree of confidence. The weighted average for all questions relating to Hypothesis #2 calculates to 3.84 out of 5; if 5 represents a feeling of confidence, then 3.84 may reveal a foundation of confidence mixed with aspects of apprehension. Hypothesis #2 must also be rejected because Army providers clearly do not always feel competent and confident in their ability to perform oral cancer screenings.



**Hypothesis #3: The practices and habits of providers for oral cancer screenings in the Army are optimal.**

Data responses in the "strongly disagree" to "neutral" scores for questions 2, 4, 7, 8, 15-17, 20, 21, and 23 pertain to hypothesis 3 and may show lax habits in oral cancer screening.

**2. I follow a specific protocol for oral cancer screening.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	9	4.1	4.1	4.1
3	12	5.5	5.5	9.7
4	93	42.9	42.9	52.5
5	103	47.5	47.5	100.0
Total	217	100.0	100.0	

The investigator assumed that a thorough oral cancer screening follows a specific protocol to prevent areas of the oral cavity from being skipped or poorly examined. 9.7% of respondents disagreed or replied neutrally to this statement soliciting the question, "Are the oral cancer screenings of those providers competent and thorough?" 90.3% of respondents reported following an oral cancer screening protocol.

**4. I have enough time during patient exams for oral cancer screening.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	6	2.8	2.8	2.8
2	20	9.2	9.3	12.0
3	31	14.3	14.4	26.4
4	98	45.2	45.4	71.8
5	61	28.1	28.2	100.0
Total	216	99.5	100.0	
Missing	1	.5		
Total system	217	100.0		

This question seeks to determine whether time constraints during exams lower the rate of oral cancer screenings. 12.0% of respondents feel that they do not have time during exams to perform oral cancer screenings, while 73.6% of respondents feel that they do have adequate time. Perhaps the respondents that disagreed with this statement work at a slower than average rate, or their case load tends to be more difficult and time-consuming. The opposite may be true with the 73.6% that agreed with this statement: they may execute faster or tend to receive simpler cases and therefore do not need more time for screenings. At any rate, time constraint seems to be a factor for some providers in performing oral cancer screenings.

**7. Army general dentists should perform oral cancer biopsies.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	7	3.2	3.3	3.3
2	35	16.1	16.3	19.5
3	60	27.6	27.9	47.4
4	83	38.2	38.6	86.0
5	30	13.8	14.0	100.0
Total	215	99.1	100.0	
Missing	2	.9		
Total system	217	100.0		

Statement #7 attempts to gauge the level of involvement Army general dentists feel they should have in detecting and diagnosing oral cancer. 52.6% of the respondents felt that Army general dentists should perform oral cancer biopsies, while 19.5% felt that they should not. Although the investigator can determine the amount of those who disagree, their reasons for disagreement cannot be determined by the question, but may refer to level of confidence and training.

**8. I always educate my patients on risk factors for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	28	12.9	13.0	13.0
3	52	24.0	24.2	37.2
4	88	40.6	40.9	78.1
5	47	21.7	21.9	100.0
Total	215	99.1	100.0	
Missing	2	.9		
Total system	217	100.0		

Are patients being educated about oral cancer risks? Are providers educating their patients about oral cancer risks? 68.2% of providers agreed with the statement, "I always educate my patients on risk factors for oral cancer," while 37.2% did not. So, of the 68.2% that always educate their patients about risk factors for oral cancer, what specifically are they teaching their patients? Are they teaching correct information? How thoroughly do they cover the topic? Are their patients receiving oral cancer education anywhere else? Do providers educate their patients about the cancer risks of oral sex?

**15. I always educate my patients on self-monitoring for oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	6	2.8	2.8	2.8
2	60	27.6	28.0	30.8
3	57	26.3	26.6	57.5
4	66	30.4	30.8	88.3
5	25	11.5	11.7	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

Because the patient may have the first opportunity to spot a cancerous lesion, patient education and awareness is critical. Only 42.5% of respondents report always educating their patients on self-monitoring for oral cancer, which means that up to 57.5% do not. Again, what are the providers teaching? How thorough do they cover the topic? Do the patients understand the information? Do providers disseminate correct information? Furthermore, the number of providers that do not educate their patients on self-monitoring for oral cancer is substantial.

**16. I routinely refer patients who smoke to a cessation program.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	10	4.6	4.7	4.7
2	77	35.5	36.0	40.7
3	55	25.3	25.7	66.4
4	56	25.8	26.2	92.5
5	16	7.4	7.5	100.0
Total	214	98.6	100.0	
Missing	3	1.4		
Total system	217	100.0		

This statement was meant to measure provider effort in improving oral health and oral cancer prevention, and in part tests M. Chisick's theory that military dentists do not regularly advise their patients to quit smoking (13). 66.4% of respondents reported that they do not routinely refer patients who smoke to a cessation program.

**17. I always examine radiographs for signs of oral cancer.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	5	2.3	2.3	2.3
2	16	7.4	7.5	9.9
3	24	11.1	11.3	21.1
4	102	47.0	47.9	69.0
5	66	30.4	31.0	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

This statement attempts to measure providers' diligence when screening for oral cancer. 78.9% of respondents reported that they always examine radiographs for signs of oral cancer, while 21.1% do not. Of those 21.1% that do not always examine x-rays for signs of oral cancer, how often do they examine x-rays for signs of oral cancer? Do they know how oral cancer appears on x-rays? Do they examine the patient for oral cancer using other methods?

**20. When I see an oral lesion, I ensure that my patient undergoes a follow-up.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
2	3	1.4	1.4	1.4
3	13	6.0	6.1	7.5
4	115	53.0	54.0	61.5
5	82	37.8	38.5	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

Because many oral lesions are not cancerous and resolve on their own, oral cancer biopsies are not appropriate for every lesion. Since 92.5% of the respondents agreed with the statement "When I see an oral lesion, I ensure that my patient undergoes a follow-up," most providers show an understanding of this fact. However, the following questions should be asked: How long do providers suggest a patient wait for a follow-up? How long do patients actually wait for a follow-up appointment? How do providers ensure that their patient is seen for a follow-up? At what rate are follow-up appointments for suspicious oral lesions occurring?

**21. I feel that 5 minutes or less is enough time to educate patients on oral cancer risk.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	3	1.4	1.4	1.4
2	32	14.7	15.0	16.4
3	48	22.1	22.5	39.0
4	110	50.7	51.6	90.6
5	20	9.2	9.4	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

While 61.0% of respondents agreed with this statement, 16.4% of respondents felt that 5 minutes is not enough time to educate patients on the risks of oral cancer. An appropriate question to ask in this situation may be "What quality and quantity of education would you like to give your patients about their risks for oral cancer?" Perhaps the 61% that agreed with this statement feel that they can present a minimal amount of information, or that they can provide a comprehensive risk assessment quickly. Maybe the 16.4% would like more time to ensure a careful presentation of facts and patient understanding.

**23. I educate my patients on the oral cancer risk of HPV.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
1	16	7.4	7.5	7.5
2	93	42.9	43.7	51.2
3	47	21.7	22.1	73.2
4	46	21.2	21.6	94.8
5	11	5.1	5.2	100.0
Total	213	98.2	100.0	
Missing	4	1.8		
Total system	217	100.0		

How many providers talk to their patients about the oral cancer risks of unprotected oral sex? Apparently, most - as many as 73.2% - do not. There could be many reasons for this lack of education, but the investigator assumes that either the providers are unaware of this risk, or the topic is uncomfortable and therefore avoided. While 68.2% of providers agreed with statement #8, "I always educate my patients on risk factors for oral cancer," most exclude discussing HPV/oral sex as a main cause of oral cancer as seen from the data for statement #23. Therefore, what information are patients receiving about oral cancer from the providers?

Significant amounts of providers do not follow a specific oral cancer screening protocol (13.8%) nor do many feel that they have enough time during patient exams for oral cancer screenings (26.4%). Although this data does not prove that they are not performing oral cancer

screenings, it corresponds with the data for question 28 which states, "I adhere to Army treatment guidelines requiring oral cancer screenings for all new and recall patients" since 13.7% of respondents do not adhere to that guideline.

The scattered data for question 7 shows a large range of opinion about whether Army dentists should perform oral cancer biopsies. Perhaps this range is due to lack of confidence or knowledge in performing biopsies, that perhaps another specialty should be responsible for that procedure.

The scores pertaining to "patient education" questions (8, 15, 16, 21, 23) scored lower than questions pertaining to providers' other duties (4, 7, 17, 20) regarding oral cancer screening: "patient education" had a weighted average of 3.2 while other provider duties scored 3.9. The difference is 8%, a statistically significant amount. This score showed the lowest agreement of all sections in the study. The data, therefore, leads the investigator to believe that, although practitioners perform oral cancer screenings, they lack consistency in their habits.

If the practices and habits of oral cancer screenings in the Army were optimal, the scores corresponding to this hypothesis would be closer to 5. The combined weighted average of this section is the lowest of all sections - 3.71 - which is 26% below optimal. The investigator must therefore reject Hypothesis 3 because the practices and habits of providers for oral cancer screenings in the Army are not optimal.

## Conclusion

Recent growth in technologies that can detect oral cancer in early stages has many providers eager to employ these new gadgets in practice. The new technologies are based on cellular reflectance and fluorescence, or on vital stains and lights that can reveal early stages of mutation (15, 19). While dental science produces technologies that come closer to detecting early stage oral cancers, some experts warn that reliance on any such technology without standard oral cancer screenings will fail. Brian Hill, Founder and Executive Director of the Oral Cancer Foundation, states:

“It is an exciting time for science and oral cancers. But any of these devices as a stand-alone technology is useless. In the end, it is the non-complacent practitioner who is involved in routinely examining all of their patient population, educated in what they are looking at, using their own eyes and incorporating a tactile component to the exam, that will make the difference (19).”

Scientists, experts, and researchers emphasize the crucial element of screening for early detection to increase survival rates and quality of life post-treatment. In the elevated-risk population of the Army, oral cancer screening for the early detection of cancer must be taken seriously. The investigator posed several questions at the beginning of the paper for discussion:

Do Army dental providers perform regular oral cancer screenings as mandated by DO 120, DO 150, and DO 180? Yes, according to this study they perform regular oral cancer screenings as mandated by the DoD. However, the data raises the questions of the regularity and quality of the screenings.

Do Army dental providers feel that oral cancer screenings are important services to provide? Yes, according to this study they feel that oral cancer screenings are important services to our Soldiers.

Do Army dental providers feel competent and confident in their ability to perform proper oral cancer screenings? The data show mixed results for this question. Although flaws inherently exist in self-reporting measures, the data in this study suggest that oral cancer screenings in the Army can be improved by increasing the confidence level of providers through more oral cancer screening education.

Are Army dental providers educating their patients on oral cancer risk factors? Most providers report educating their patients on oral cancer risk factors, but also report on NOT educating them about the risks of unprotected oral sex, the main cause of oral cancer in younger

patients. This discrepancy raises the question of what other issues providers avoid discussing with their patients.

The investigator would like to propose several suggestions to improve the level of oral cancer screenings in the Army:

1. Officer Professional Development (OPD) may present a prime opportunity to increase oral cancer knowledge and screening skills, which may in turn increase confidence and competence. Guest speakers, video modules, and reading materials may be beneficial to the Army dental providers.

2. Enable the Soldiers to be their own "first responders" for their health. Increase education at the patient level to improve cancer screening outcomes and detection. For example, the TV's in the dental waiting rooms currently show CNN, The View, or other network programming. Use the waiting-time as an opportunity to educate. Replace those shows with educational programming about the risks of HPV, self-monitoring for oral cancer, risk factors for oral cancers, and dental hygiene.

3. Have printed materials about oral cancer, or other uncomfortable topics like oral sex risks, ready to give to patients.

4. Encourage chairside education when possible. That way, the information can be specific to the patient, come from an authority, and the dentist has a captive audience.

5. A specific oral cancer screening protocol employed by the Army may increase screening rates and quality, thereby protecting our Soldiers from late-stage oral cancers.

6. As much as possible, keep patients with the same provider for recall exams to increase the chances of providers noticing changes in oral tissues.

7. Allot time during exams specifically for oral cancer screenings.

As providers become more competent and compliant with oral cancer screening, finding oral cancer in its early stages could be one of the best days for a professional as they've significantly increased a patient's survival outcome and quality of life.

\*The views expressed in this presentation are those of the author and do not reflect the official views of the Department of Defense nor other departments of the United States government.



## **Appendix A: E-mail with Survey Link**

Study: Provider Compliance and Competence with Oral Cancer Screenings in the U.S. Army

U.S. Army Dentists (63A and 63B):

We are contacting you to invite you to participate in a study using an anonymous survey that will ask several questions related to oral cancer screenings in the U.S. Army. This survey is 28-questions long and should take less than 5 minutes to complete.

Please click on the link to direct you to the survey:

<https://www.surveymonkey.com/s/VJ82NN6>

This survey is intended for active duty military personnel only and participation is voluntary. Although participation is not required, it is greatly appreciated. Please do not type in any personal identifying information on this survey. This survey is to remain anonymous.

This information will be used for a research study that is being conducted to help improve future Army dental care for all Soldiers. Information gained from your participation in this study may be published in medical literature, discussed for educational purposes, and used generally to further dental science. As no identifiable information is collected, you will not be personally identified; all information will be presented as anonymous data.

Principal Investigator: MAJ Cory Richards, DDS at [cory.d.richards3.mil@mail.mil](mailto:cory.d.richards3.mil@mail.mil)

Thank you.

## **Bibliography**

1. AMEDD - DENTAC. 2014. "DoD Guidelines for Dental Procedure Codes and Dental Weighted Values." Department of Defense, US Army. (accessed January 7, 2015).
2. American Cancer Society. 2015. "Can oral cavity and oropharyngeal cancers be found early?" <http://www.cancer.org/cancer/oralcavityandoropharyngealcancer/detailedguide/oral-cavity-and-oropharyngeal-cancer-detection> (accessed January 10, 2015).
3. American Cancer Society. 2015. "Signs and symptoms of oral cavity and oropharyngeal cancer." <http://www.cancer.org/cancer/oralcavityandoropharyngealcancer/detailedguide/oral-cavity-and-oropharyngeal-cancer-signs-symptoms> (accessed January 10, 2015).
4. American Cancer Society. 2015. "Survival rates for oral cavity and oropharyngeal cancer by stage." <http://www.cancer.org/cancer/oralcavityandoropharyngealcancer/detailedguide/oral-cavity-and-oropharyngeal-cancer-survival-rates>. (accessed January 10, 2015).
5. American Cancer Society. 2015. "Treatment options for oral cavity and oropharyngeal cancer by stage." <http://www.cancer.org/cancer/oralcavityandoropharyngealcancer/detailedguide/treatment-options-for-oral-cavity-and-oropharyngeal-cancer-by-stage>. (accessed January 10, 2015).
6. American Dental Association. 2015. "Oral and Pharyngeal Cancer." [www.ada.org/en/membercenter/oral-health-topics/oral-cancer](http://www.ada.org/en/membercenter/oral-health-topics/oral-cancer). (accessed January 8, 2015).
7. Ames, Genevieve, Carol Cunradi. 2004. "Alcohol use and preventing alcohol-related problems among young adults in the military." [pubs.niaaa.nih.gov/publications/arh284/252-257.htm](http://pubs.niaaa.nih.gov/publications/arh284/252-257.htm). (accessed Dec. 4, 2015).
8. British Dental Journal. 2007. "More training in oral cancer detection needed." vol. 202 Issue 12, p712-712.
9. Cancer Treatment Centers of America. 2015. "Oral cancer risk factors." [www.cancercenter.com/oral-cancer/risk-factors](http://www.cancercenter.com/oral-cancer/risk-factors). (accessed Nov. 30, 2015).
10. Centers for Disease Control and Prevention. 2013. "Focus on the treatment of STDs in military populations." <http://www.cdc.gov/std/treatment/2010/military-webinar-slides.pdf>. (accessed Dec. 4, 2015).
11. Centers for Disease Control and Prevention. 2014. "HPV fact sheet." [www.cdc.gov/std/hpv/stdfact-hpv.html](http://www.cdc.gov/std/hpv/stdfact-hpv.html). (accessed January 17, 2015).
12. Centers for Disease Control and Prevention. 2013. "Human papillomavirus (HPV) and oropharyngeal cancer fact sheet." [www.cdc.gov/std/hpv/stdfact-hpvandoralcancer.htm](http://www.cdc.gov/std/hpv/stdfact-hpvandoralcancer.htm). (accessed Dec. 4, 2015).

13. Chisick, M. C. 2000. "Do military dentists advise tobacco users to quit? The patient's perspective." *Public Health (Nature)* 114, no. 2: 129. Biomedical Reference Collection: Comprehensive. (accessed January 8, 2015).
14. Daily Caller. 2015. "Rate of smoking are down, but still high in the military." <http://dailycaller.com/2015/09/09/rates-of-smoking-are-down-but-not-in-the-military/?print=1>. (accessed Nov. 30, 2015).
15. Ebihara, A., T.B. Krasieva, L.H. Liaw, S. Fago, D. Messadi, K. Osann, P. Wilder-Smith. 2003. "Detection and diagnosis of oral cancer by light-induced fluorescence." *Laser Surg Med.*; 32(1); 17-24.
16. Garewal, Harinder. 1995. "Antioxidants in oral cancer prevention." *American Journal of Clinical Nutrition* 62 (6 Suppl): 1410S-1416S. [www.ncbi.nlm.gov/pubmed/7495239](http://www.ncbi.nlm.gov/pubmed/7495239). (accessed Nov. 30, 2015).
17. Gholipour, Bahar. "Hidden STD epidemic: 110 million infections in the U.S." LiveScience. <http://www.livescience.com/48100-sexually-transmitted-infections-50-states-map.html>. (accessed Dec. 4, 2015).
18. Glenny, K.O., R.J. Oliver, N. Thakker, P. Sloan. 2014. "Screening programmes for the early detection and prevention of oral cancer." American Dental Association. [www.ada.org/screening-programmes-for-the-early-detection-and-prevention-of-oral-cancer](http://www.ada.org/screening-programmes-for-the-early-detection-and-prevention-of-oral-cancer). (accessed Jan. 10, 2015).
19. Hill, Brian. 2007. "Early oral cancer discovery: technique or technology? A personal opinion." Aegis publishing. [http://www.oralcancerfoundation.org/about/pdf/editorial\\_hill\\_07.pdf](http://www.oralcancerfoundation.org/about/pdf/editorial_hill_07.pdf). (accessed Dec. 31, 2015).
20. Hlad, Jennifer. 2012. "US military's alcohol-soaked culture taking toll on servicemembers." [www.stripes.com/us-military-s-alcohol-soaked-culture-taking-toll-on-servicemembers-1.201959](http://www.stripes.com/us-military-s-alcohol-soaked-culture-taking-toll-on-servicemembers-1.201959). (accessed Dec. 4, 2015)
21. Jelinek, Pauline. 2012. "Military alcohol abuse 'culture' is now in 'crisis', report finds." [www.huffingtonpost.com/2012/09/18/military-alcohol-abuse-drug-drinking\\_n\\_1893360.html](http://www.huffingtonpost.com/2012/09/18/military-alcohol-abuse-drug-drinking_n_1893360.html). (accessed Dec. 4, 2015).
22. Kerr, Ross. 2014. "Oral Cancer Screening." American Academy of Oral Medicine. [http://www.aaom.com/index.php?option=com\\_content&view=article&id=160:clinical-practice-statement--oral-cancer-screening&catid=24:clinical-practice-statement&Itemid=180](http://www.aaom.com/index.php?option=com_content&view=article&id=160:clinical-practice-statement--oral-cancer-screening&catid=24:clinical-practice-statement&Itemid=180) (accessed January 7, 2015).
23. Kujan O., A. M. Glenny, R. J. Oliver, N. Thakker, P. Sloan. 2006. "Screening programmes for the early detection and prevention of oral cancer." <http://ebd.ada.org/en/evidence/evidence-by-topic/oral-head-and-neck-cancer/screening-programmes-for-the-early-detection-and-prevention-of-oral-cancer> (accessed January 10, 2015).

24. Lee, S. Steve, and Kangmin Zhu. 2014. "Smokeless Tobacco Use in the U.S. Military." Walter Reed National Military Medical Center: Murtha Cancer Center. (accessed May 25, 2015).
25. National Institute of Dental and Craniofacial Research. 2014. "Oral Cancer." [www.nidcr.nih.gov/oralhealth/topics/oralcancer](http://www.nidcr.nih.gov/oralhealth/topics/oralcancer). (accessed Dec. 3, 2015).
26. National Institute on Drug Abuse. 2013. "Drug facts: Substance abuse in the military." [www.drugabuse.gov/publications/drugfacts/substance-abuse-in-military](http://www.drugabuse.gov/publications/drugfacts/substance-abuse-in-military). (accessed Dec. 4, 2015).
27. National Institute of Health. 2014. "NIH study offers insight into why cancer incidence increases with age." [www.nih.gov/news-events/news-releases/nih-study-offers-insight-into-why-cancer-incidence-increases-age](http://www.nih.gov/news-events/news-releases/nih-study-offers-insight-into-why-cancer-incidence-increases-age). (accessed Dec. 1, 2015).
28. Nelson, Jenenne P., Linda L. Pederson, and Judene Lewis. 2009. "Tobacco use in the Army: illuminating patterns, practices, and options for treatment." *Military Medicine* 174, no. 2: 162-169. (accessed January 8, 2015).
29. NPR. 2008. "Study: Military smoking rates higher than public." <http://www.npr.org/templates/story/story.php?storyId=96476915>. (accessed Nov. 30, 2015).
30. Oral Cancer Foundation. 2015. "Cancer screening protocols." <http://www.oralcancerfoundation.org/discovery-diagnosis/screening.php> (accessed January 7, 2015).
31. Oral Cancer Foundation. 2011. "HPV now the leading cause of oral cancers in the U.S." <http://www.oralcancerfoundation.org/presskit/ocf-pr.php> (accessed Dec. 31, 2015).
32. Oral Cancer Foundation. 2015. "Oral cancer facts." <http://www.oralcancerfoundation.org/facts/> (accessed January 7, 2015).
33. Oral Cancer Foundation. 2015. "Public description of a proper exam." [http://www.oralcancerfoundation.org/discovery-diagnosis/how\\_do\\_you\\_know.php](http://www.oralcancerfoundation.org/discovery-diagnosis/how_do_you_know.php) (accessed January 7, 2015).
34. Oral Cancer Foundation. 2015. "Risk factors." [http://www.oralcancerfoundation.org/dental/risk\\_factors.php](http://www.oralcancerfoundation.org/dental/risk_factors.php) (accessed January 10, 2015).
35. Oral Cancer Foundation. 2015. "Why screening works." [http://www.oralcancerfoundation.org/dental/why\\_screening\\_works.php](http://www.oralcancerfoundation.org/dental/why_screening_works.php) (accessed January 10, 2015).
36. Peterson, Alan L., Herb H. Severson, Judy A. Andrews, Sherrie P. Gott, Jeffrey A. Cigrang, Judith S. Gordon, Christine M. Hunter, and Gary C. Martin. 2007. "Smokeless tobacco use in military personnel." *Military Medicine* 172, no. 12: 1300-1305. (accessed January 8, 2015).

37. Prince, Pamela. 2014. "Oral cancer screening: improving early detection." *Dental Nursing* 10, no. 12: 692-695. Dentistry and Oral Sciences Source. (accessed January 8, 2015).
38. Silverman Jr., Sol, Nancy J. Fischbein, and William P. Dillon. 2003. "Chapter 4: Diagnosis." In *Oral Cancer, Fifth Edition - American Cancer Society, Atlas of Clinical Oncology*, 48-80. : People's Medical Publishing House USA Ltd. PMPH). Dentistry & Oral Sciences Source. (accessed January 8, 2015).
39. Statistic Brain. 2015. "Age distribution of active duty force." [www.statisticbrain.com/demographics-of-active-duty-u-s-military](http://www.statisticbrain.com/demographics-of-active-duty-u-s-military). (accessed Dec. 3, 2015).
40. U.S. Army Public Health Command. 2015. "Just the facts...oral cancer." <http://chppm-www.apgea.army.mil/dhpw/oralfitnessmain.aspx>. (accessed May 25, 2015).
41. U.S. Medicine. 2013. "Military responds to high rates of STI's in active-duty female servicemembers." <http://www.usmedicine.com/agencies/departments-of-defense-dod/military-responds-to-high-rates-of-stis-in-active-duty-female-servicemembers/>. (accessed Dec. 4, 2015).
42. U.S. Medicine. 2015. "Repercussions of high military smoking rates affect health systems." <http://www.usmedicine.com/non-clinical-topics/pharmacy/repercussions-of-high-military-smoking-rates-affect-health-systems>. (accessed Nov. 28, 2015).
43. Xu, Zongli, Jack Taylor. 2014. "Genome-wide age-related DNA methylation changes in blood and other tissues relate to histone modification, expression, and cancer." *Carcinogenesis*; doi: 10.1093/Carcin/bgt 391.